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IS 12257-3 (1992): Pneumatic measurement, Part 3:
Parameters of instruments working on high pressure [PGD 25:
Engineering Metrology]



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वायुचालित मापन

भाग 3 उच्चदाब के अधीन कार्य करने वाले उपकरणों के पैरामीटर

Indian Standard

PNEUMATIC MEASUREMENT

**PART 3 PARAMETERS OF INSTRUMENTS
WORKING ON HIGH PRESSURE**

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Engineering Metrology Sectional Committee had been approved by the Light Mechanical Engineering Division Council.

Air gauging has been gaining wider acceptability in industry because of its accuracy, consistency and reliability. These can be used for on line measurement of parts as they are being machined and take corrective actions.

This standard specifies the various parameters required for high pressure range pneumatic instrument for dimensional measurements. It is not possible to specify the values of all parameters, since they differ with different measuring instruments. It basically forms a guideline for the user to choose the right measuring instrument. The values and the testing have been specified based on the general practices of the manufacturers.

This Indian Standard has been published in four parts. Other parts of this standard are listed below:

- Part 1 General information on principles and methods.
- Part 2 Design features of instruments working in high pressure range, and
- Part 4 General information and examples of application.

In the preparation of this standard considerable assistance has been derived from DIN 2271 (Teil 3)-76 'Pneumatic Length Measurement (Air Gauging) Parameters of Instruments Working in the High Pressure Range Requirements Testing' issued by the Deutsches Institut für Normung (DIN).

Indian Standard

PNEUMATIC MEASUREMENT

PART 3 PARAMETERS OF INSTRUMENTS WORKING ON HIGH PRESSURE

1 SCOPE

This standard covers the parameters of pneumatic instruments used for dimensional measurement which operate with a system pressure ≥ 50 kPa (0.5 bar).

2 REFERENCE

IS 2092 : 1983 'Plunger type dial gauges (*first revision*)' is necessary adjunct to this standard.

3 TERMINOLOGY

3.1 Supply Pressure

The supply pressure is the pressure that exists before the pressure regulator of pneumatic length measuring instrument.

3.2 System Pressure

The system pressure is the pressure that exists after the pressure regulator. This may also be termed as primary pressure.

3.3 Secondary Pressure

In the case of instruments which use the pressure measuring method, the secondary pressure is the pressure that exists between the pilot jet and measuring jet.

3.4 Air Consumption

The air consumption is the quantity of air flowing from the instrument in a specified time.

3.5 Setting Time

The setting time refers to the period of time which is required to adjust instrument so that the indicated value remains within 1% of the measuring range that is, the time taken in transition of free air flow to measuring value flow.

3.6 Sensitivity

The sensitivity is the ratio of the change in the indication to the change of the quantity to be measured, which causes this change.

When changing the sensitivity, the elements which govern the sensitivity must be changed. These are:

- a) In the case of column instrument — gauging element measuring tube with floating body and scale
- b) In the case of indicating instruments — gauging element, pilot jet and scale

3.7 Measuring Force

The measuring force is the force which the gauging element exerts on the object being tested.

With gauging elements which operate without contact with the work surface the measuring force is created by the air flowing out of the jet onto the object being tested. This measuring force in most of the cases can be neglected.

With mechanical contact type of gauging element it is the force exerted by the contacts on the object under test and this must be taken into account.

3.8 Cumulative Error

The cumulative error is the ordinate distance between the highest and the lowest point on the curve of the actual variations of the indicated value over the measuring range.

3.9 Repeatability

The repeatability is the difference between the maximum and the minimum indicated value with repeated measurements at a specific point of the measuring range.

4 REQUIREMENT

4.1 Parameters

Parameters given in Table 1 shall be specified in the technical literature of each manufacturer.

Table 1 Parameters

Parameter	Unit
Measuring range	μm
Scale value	μm
Sensitivity	
Supply pressure	Pa
System pressure	Pa
Air consumption	m ³ /h
Setting time	s

4.2 Permissible Deviation

Permissible deviations of the indicating instrument including the gauging element given in Table 2 apply when the indicating instrument is in normal position and the gauging element mounted directly on the instrument.

4.3 Scale

4.3.1 The scale shall be graduated with well defined lines which are legible and clearly visible.

4.3.2 The width of the graduation lines should be about 10% to 15% of the spacing between them.

4.3.3 The distance between the centres of adjacent graduations shall be at least 4 mm in the case of column type units and at least 2 mm in the case of indicating instruments.

4.3.4 The scale value shall be clearly marked on the dial with the numerical value and the units.

5 TESTING

5.1 The indicating instrument shall be checked with a selected open jet measuring probe as a test standard.

5.1.1 The gauging element, that is, the air plug or air ring is tested with a calibrated indicating instrument.

5.2 Cumulative Error

5.2.1 In the case of pneumatic instruments which are used with a mechanical contact air probe gauging element in a manner similar to dial gauges as per IS 2092 : 1983, the cumulative error is determined by moving measuring pins in steps of 10 scal divisions under the contact point starting from middle of the range on both sides.

5.2.2 In the case of pneumatic instruments using all other types of gauging elements shall be checked by at least 3 setting standards. The sizes of the setting standards shall be such that 2 of them lie within the maximum measuring range limit and others are equally distributed over the measuring range.

The observed values should not exceed the value

given in Table 2.

5.3 Repeatability

The repeatability may be determined at any position on the measuring range by 5 measurements. The maximum difference thus obtained shall not exceed the value given in Table 2.

5.4 Hysteresis of the Measured Value

In the case of pneumatic length measuring instruments, the hysteresis of the measured value is determined from 5 measurements in the middle of the measuring range. The arithmetic mean value shall not exceed the values given in Table 2.

If nevertheless these values are exceeded, the indicating instrument shall be verified with a jet measuring probe since this is a negligible small hysteresis of the measured value. The difference between the hysteresis of the measured value of the pneumatic instrument and that of the indicating instrument then gives the hysteresis of the measured value sensor.

5.5 Measuring Force and Hysteresis of the Measuring Force

In the case of mechanical contact gauging elements the measuring force and hysteresis of the measuring force are measured over the whole measuring range by moving the setting standard points. This shall not show values more than specified in Table 2.

Table 2 Range of Permissible Variations
(Clauses 4.2, 5.3, 5.4 and 5.5)

Parameters	Range of Permissible Variations	
	Non-Contact Gauging Element	Mechanical Contact Gauging Element
a) Cumulative Error without compensation	1.5 div	1.5 div
b) Cumulative Error with compensation	1 div	1 div
c) Repeatability	0.5 div	0.5 div
d) Hysteresis of the measured value	0.5 div	0.5 div
e) Hysteresis of the measuring force	Negligible	0.2 N
f) Maximum change of measuring force for the same direction of movement	Negligible	0.2 N

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